Small Business Innovation Research/Small Business Tech Transfer

Low Cost Radiation Hardened Flash Memory Integrated Circuit, Phase I

Completed Technology Project (2018 - 2019)

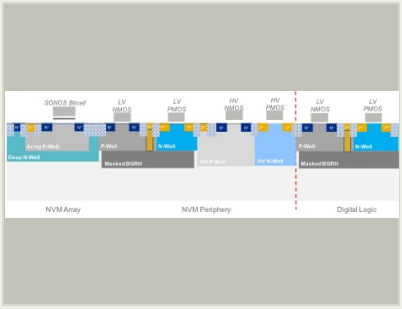
Project Introduction

There is a strong demand for radiation hardened Non-Volatile Memory (NVM) for all digital control based space applications. There are limited options available to designers today, consisting of up-screened commercial memories and devices with constrained radiation performance specifications.VORAGO Technologies propose to harden an existing proven (but not yet radiation-hardened) SONOS Flash memory technology that is available from SkyWater CMOS wafer fab. Our confidence in success is based on the fact that we have successfully hardened SRAM memories and other similar CMOS devices using the same HARDSIL® technology that we will apply to the SkyWater Flash memory. A successful outcome to this project will result in a radiation-hardened flash memory IC that can be qualified for space flight and ultimately a portfolio of rad-hard flash memory products that can be used in many applications where programmable non-volatile storage is required. The SkyWater flash memory IP has been in production for many years on a commercial (non rad-hard) flow and has shipped billions of units through that particular SkyWater fab. It is very robust technology. One of the main benfits of this proposal is that we can piggyback upon this high volume flow with a simple modification to facilitate the radiation hardening.

Anticipated Benefits

We believe that the availability of a high-specification radiation-hardened flash memory would be a very popular product for NASA space-based observatories, fly-by spacecraft, orbiters, landers and robotic / sample return missions that require robust command and control capabilities. The alternatives are up-screened devices with very limited radiation performance. Every programmable digital board that is used in every spacecraft requires a non-volatile memory device to store program code. This device could be used in each of these applications. Flash is an attractive alternative to all other types of substitute memory types as it is dense, low power, doesn't need masks to program, doesn't need high programming voltages and it is fast. Some examples of functions of the low-cost radiation hardened flash memory integrated circuit are: -Program storageBootloader -Personality / customization data storage -Calibration data -Payload sensor storage data It would be possible to create a family of products of different densities to meet many application requirements. We would start with a device around 64Mbit density and then propose to create a full family of devices with higher memory sizes. It is possible to include different types of memory interfaces on the chips (both serial and parallel) to meet all possible space applications.

We believe that the availability of a high-specification radiation-hardened flash memory would be a very popular product for many aerospace and military applications. As with NASA applications, this function is required everywhere that there is a programmable chip such as a processor, including ASICs and



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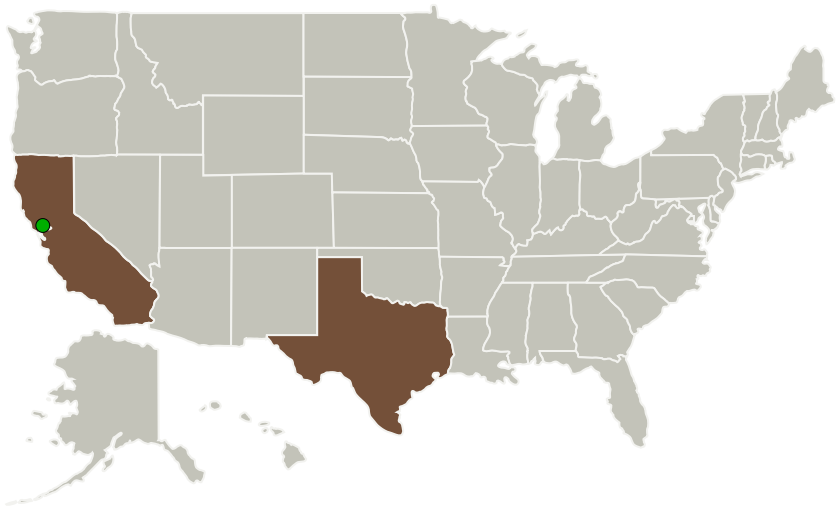
FPGAs. Today, the market relies upon up-screened technology that does not have strong radiation specifications. Despite their poor performance, today's solutions are expensive and often have very long availability lead-times.VORAGO can improve on radiation performance as well as lead time because instead of relying upon up-screening, the VORAGO flash memory devices will be fabricated in a high-volume wafer fab that is running a commercial CMOS flow that is only slightly modified by HARDSIL® technology.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Silicon Space Technology Corporation	Lead Organization	Industry	Austin, Texas
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Silicon Space Technology Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

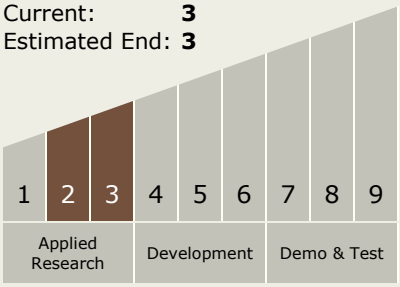
Carlos Torrez

Principal Investigator:

Ross Bannatyne

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Project Transitions

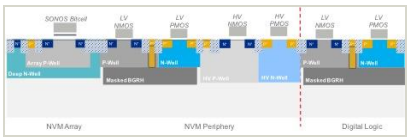
July 2018: Project Start

February 2019: Closed out

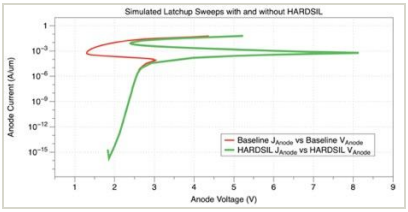
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137853)*

Images



Briefing Chart Image
Low Cost Radiation Hardened Flash Memory Integrated Circuit, Phase I *(https://techport.nasa.gov/image/128559)*



Final Summary Chart Image
Low Cost Radiation Hardened Flash Memory Integrated Circuit, Phase I *(https://techport.nasa.gov/image/125908)*

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.4 Information Processing
    - TX11.4.4 Collaborative Science and Engineering

Target Destinations

The Moon, Mars, Others Inside the Solar System